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Enhancement of RIVPACS for biological assessment of the quality of Scottish rivers

A progress report for the period April 1992 to October 1992

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The Institute of Freshwater Ecology is part of the Terrestrial and Freshwater Sciences Directorate of the Natural Environment Research Council.

1. INTRODUCTION

RIVPACS (River InVertebrate Classification and Prediction System) is a software package devised by the Institute of Freshwater Ecology (IFE). It has applications in the biological classification of running-water sites and the assessment of their biological quality. RIVPACS produces site-specific predictions of the macro-invertebrate fauna to be expected, in the absence of stress, at sites of known environmental characteristics. Site quality is evaluated by the degree to which the fauna captured at a site conforms with the taxa predicted to occur. The system was extensively used in the 1990 River Quality Survey of Scotland, England and Wales.

Underpinning RIVPACS is a data-base containing species identifications and environmental information for 438 running-water sites in Britain. Of these, 102 (23%) are from Scotland and the remainder from England and Wales. These data are used to provide predictions by a process of comparison-by-analogy between the sites in the data-base and the sites being assessed. The reliability of a new site prediction is dependent upon there being adequate representation, in RIVPACS, of sites with comparable physical and chemical characteristics.

IFE is currently reviewing the effectiveness of RIVPACS and seeking to enhance the system by identifying and rectifying its deficiencies. The overall performance of RIVPACS, for use with the 1990 River Quality Survey, appears to have been generally good. However, IFE's review has shown scope for improvement in certain river types (eg headwaters and chalk streams) and geographic areas (eg south-west English moorlands). The River Purification Boards (RPBs) have also suggested that the reliability of RIVPACS predictions would be improved by the addition of extra Scottish sites.

Since the construction of RIVPACS in 1988 a further 103 sites have become available for inclusion in a future version as a result of surveys undertaken for what was the Nature Conservancy Council. Of these only 17 (16.5%) are from Scotland. The NRA-funded Headwater Stream project will add approximately 53 sites in England and Wales and the NRA project entitled Testing and Further Development of RIVPACS will result in the addition of a further 50 sites in England and Wales. It is expected that the inclusion of these extra samples will overcome most of the weaknesses of the current system for England and Wales.

The current contract allows for a minimum of 30 new sites in Scotland and therefore by March 1994 approximately 674 sites will be available in Great Britain of which 149 (22%) will be in Scotland. Hence this contract ensures that the level of representation of sites in Scotland in RIVPACS II will be maintained in the next version of the system.

2. OBJECTIVES

The primary objective is as follows:

- to increase the number of Scottish sites in the extended version of RIVPACS and thereby improve the reliability of biological quality assessment for Scottish rivers.

In addition, there are two subsidiary objectives:

- to provide a detailed and reliable data-base of the biological condition of selected, good quality sites in Scotland as reference against which to assess ecological response to potential future environmental stress (eg climatic change, acidification, land-use change etc)

- to increase knowledge of the distribution of individual species and species assemblages of macro-invertebrates in Scotland, with particular reference to their environmental ranges, and thereby provide information of assistance in the formulation of conservation strategies.

3. PROGRESS TO DATE (APRIL-OCTOBER 1992)

3.1 Site selection

In March 1992 the IFE wrote to each River Purification Board (RPB) requesting a list of river types which are currently excluded from RIVPACS but which are worthy of consideration. The replies were collated by Mr D. Lowson of Forth RPB and made available to the IFE in April.

Two priority areas emerged. They were
a) low alkalinity sites on spatey rivers
b) lowland and coastal burns.

In the initial letter, IFE also raised the question of the need for more headwater/small stream sites, but from the letters received from the RPB regions, this was not considered a high priority area.

In the Water Quality Survey of Scotland 1990 (1992) a shortcoming of RIVPACS was noted within Solway (and Clyde) where a small number of sites were put in Class A although it was apparent that their fauna had been affected by acidification. Given that the impact of acidification on the fauna is most extreme in headwater/small streams and that in badly affected areas it is difficult to find low alkalinity sites which have escaped the effects of acidification, it would seem that this particular problem should be identified using alternative techniques. In consultation with the SOEnD it was therefore agreed that no attempt would be made to select sites which could act as reference sites against which to assess the impact of acidification.

It was further agreed that the allocation of the 30 new sites to be examined within the contract should be distributed across the RPB regions according to biological need. This was determined partly using the biological results from the 1990 Water Quality Survey but also on the need to avoid large geographical gaps within the data-base.

With this in mind and after consultation with RPB biologists, a strategy was put forward by IFE to SOEnD at the end of April detailing the approximate distribution of new sites between the seven RPBs.

Although a minimum of 30 sites was proposed in the contract, a range of 34 to 45 sites were initially highlighted. This was to take account of the possibility that a few sites would prove to be unsuitable and also that if some sites were species poor, then it might be possible to process additional samples.

Since then the details of the contract have been finalised between NERC and SOEnD. The initial proposal, costed at 91/92 prices and including a minimum of 30 sites assumed that an annual revaluation clause would be acceptable to SOEnD. In practice, this proved not to be the case and hence the potential for exceeding 30 sites has diminished. Nevertheless, 34 high priority sites have been chosen and even allowing for one or two of these sites proving to be unacceptable, the minimum of 30 new sites will be available for inclusion in the next version of RIVPACS.

The rivers, site names and grid references of the 34 locations, together with their distribution across the seven RPBs, are given in Appendix 1.

In general, the RPB biologists expressed a preference for taking new samples in 1992, rather than relying on the samples we already hold in store from the 1990 survey. This was because the identification of molluscs can be difficult after long-term storage, particularly at low alkalinity sites, since the shells tend to dissolve. Hence, with the exception of two sites on the R. Urr in Solway RPB, where the 1990 samples have been confirmed as suitable for processing, new sampling took place in 1992.

3.2 Sample and data collection

The field data-sheets for recording environmental data for each site were sent out to each RPB biologist at the end of April and the plan was for spring sampling to be undertaken in May to ensure that it conformed to standard RIVPACS procedures. The normal limits for the collection of the macroinvertebrate samples and accompanying environmental data for each site are February-May for 'spring', June-August for 'summer' and September-January for 'autumn'.

The sampling programme undertaken by the RPB biologists has proceeded with very few complications and the samples already received at the River Laboratory are shown in Appendix I.

All samples taken in spring have been delivered to the River Laboratory. At only two sites on the R. Lossie in NERPB were spring samples taken in June. In view of the late sampling date plans have been laid for a new set of samples to be taken in April/May 1993. Assuming

that this is accomplished, then the June 1992 samples will not be processed.

Summer sampling was also largely successful and 19 of the 34 samples are at the River Laboratory. To our knowledge there have been problems at just two sites on the R. Ayr where high discharge in late summer curtailed sampling. It has been agreed that the samples will be taken in 1993.

We anticipate that we will receive almost all of the samples and data sheets relating to the spring, summer and autumn sampling operation by the end of 1992.

3.3 Sample processing

In sorting each sample, representative specimens of all macroinvertebrate groups are removed for identification and, in addition, the abundance of each family (as a log. category) is also recorded. The macroinvertebrates, including Oligochaeta and Chironomidae are then identified to the best achievable level. This is normally to species, where adequate taxonomic keys are available. To date, sample processing and identification has been progressing well and by the time this report is sent out, all the spring samples (except for two sites on the R. Lossie) will have been sorted and the macroinvertebrate fauna identified to the best achievable level.

4. FUTURE WORK

The major cost within this contract is the sorting and identification of the samples collected in three seasons at each site. Now that the sampling programme itself has been agreed and is largely complete, sample processing is the major task ahead. Ideally we would hope to have completed over 50% of this work by the end of this financial year. Completion of sample processing, together with the logging and verification of the biological and environmental data for the sites can then be accommodated in 1993/94.

ACKNOWLEDGEMENTS

We are grateful to the Scottish Office Environment Department for funding this work and would like to acknowledge the help and advice we have received from both Mr R. Arnott and Mr M. Somerville of SOEnD.

In addition, it is a pleasure to record the active cooperation we have received from each of the River Purification Boards and in particular from the biologists who discussed the sites and took samples for us. Finally, thanks to Diana Morton who typed this report.

REFERENCE

Water Quality Survey of Scotland 1990. HMSO Edinburgh 1992.

APPENDIX I. Listing of the 34 high priority running-water sites for which samples are being taken in three seasons. Dates indicate that samples have been taken and also delivered to the River Laboratory. (Note: a small number of additional sites are being sampled by RPB biologists as further back-up in case any of these sites prove to be unsuitable for the next version of RIVPACS.)

RIVER	SITE	NGR	SPRING	SUMMER	AUTUMN
Clyde RPB					
Ayr	Nether Wellwood	NS 659262	19 May 92	1993	✓
Ayr	Mainholm Ford	NS 363215	19 May 92	1993	✓
Falloch	Keilator	NN 370237	12 May 92	18 Aug 92	✓
Falloch	Beinglas	NN 319187	12 May 92	18 Aug 92	✓
Forth RPB					
Cocklemill Burn	Kill Conquhar Mill	NO 482025	13 May 92	25 Aug 92	✓
Crail Burn	A917 Rd. Br.	NO 611079	13 May 92	25 Aug 92	✓
Keil Burn	Pitcruvie Castle	NO 413045	13 May 92	25 Aug 92	✓
Highland RPB					
Finnan	Glen Finnan	NM 907808	5 May 92	24 Jul 92	
Foyers	Dalcrag	NH 495187	5 May 92	28 Jul 92	
Killin	Killin Lodge	NH 530093	5 May 92	29 Jul 92	
Spean	Corrie Coille	NN 252808	12 May 92	24 Jul 92	
Treig	Fersit	NN 351782	5 May 92	24 Jul 92	
Ailort	Mon	NM 774583	5 May 92	24 Jul 92	
Ailort	Craig Ghobhair	NM 853817	5 May 92	24 Jul 92	
Shiel	Shiel Bridge	NG 935188	14 May 92	30 Jul 92	
North East RPB					
Lossie	Cloddach	NJ 203584	(10 Jun 92)	4 Aug 92	
Lossie	D/S Blackburn	NJ 185620	(10 Jun 92)	4 Aug 92	
Bervie	Inverbervie G.S.	NO 824735	15 Apr 92	28 Jul 92	
Ythan	U/S Auchterless	NJ 713412	29 May 92	1993	
Ythan	Ardlethen	NJ 925308	29 May 92	1993	
Solway RPB					
Urr	Corsock	NX 766757	2 May 90	20 Aug 90	20 Nov 90
Urr	Haugh of Urr	NX 806660	8 May 90	20 Aug 90	20 Nov 90
Southwick Burn	Nr Southwick House	NX 929574	14 May 92	30 Jul 92	1993
Tay RPB					
Earn	Forteviot	NO 048184	19 May 92		✓
Isla	Wester Cardean	NO 294466	20 May 92		✓
South Esk	Stannochy Bridge	NO 584592	28 May 92		
Braan	U/S Tay confluence	NO 023423	18 May 92		
Prosen Water	Prosen Bridge	NO 394586	20 May 92		✓
Vinny Water	Pitmuies	NO 568496	20 May 92		✓
Elliot Water	Elliot	NO 620394	20 May 92		
Kenly Water	Stravithie	NO 527112	27 May 92		✓
Tweed RPB					
Biggar Water	Biggar Public Park	NT 047371	18 May 92	1993	✓
Tarth Water	Tarth Water Foot	NT 165429	22 Apr 92	✓	✓
Eden Burn	A6089 Bridge	NT 627451	29 May 92	✓	✓

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